

this way the vertical currents in the solar atmosphere, both ascending and descending, intense absorption in sun-spots, their association with the faculæ, and the apparently continuous spectrum of the corona and its structure, find an easy solution.

We are yet as far as ever from a demonstration of the cause of the variation in the temperature of the sun; but the excess of so-called calcium with minimum sun-spots, and excess of so-called hydrogen with maximum sun-spots follow naturally from the hypothesis, and afford indications that the temperature of the hottest region in the sun closely approximates to that of the reversing layer in stars of the type of Sirius and α Lyra.

If it be conceded that the existence of these lines in the chromosphere indicates the existence of basic molecules in the sun, it follows that as these lines are also seen generally in the spectra of two different metals in the electric arc, we must be dealing with the bases in the arc also.

January 30, 1879.

W. SPOTTISWOODE, M.A., D.C.L., President, in the Chair.

The Presents received were laid on the table and thanks ordered for them.

The following Papers were read:—

I. “On the Effect of Heat on the Di-iodide of Mercury, HgI_2 .”

By G. F. RODWELL, Science Master, and H. M. ELDER, a Pupil, in Marlborough College. Communicated by Professor TYNDALL, F.R.S., Professor of Natural Philosophy in the Royal Institution. Received January 9, 1879.

In continuation of the experiments on the effects of heat on the chloride, bromide, and iodide of silver, which one of us has previously had the honour of communicating to the Society,* it was thought to be advisable to search in some of the other metallic iodides for molecular anomalies similar to those presented by the iodide of silver. Among these no substance appeared more likely to possess such anomalies than the di-iodide of mercury. This substance, as is well known, is dimorphous. In the amorphous condition it presents the appearance of a brilliant scarlet powder, which, if heated, fuses at 200°C ., and volatilises just above the fusing point to a vapour more

* “Proc. Roy. Soc.,” vol. xxv, p. 280.

than twice as dense as that of mercury. The vapour condenses to rhombic prismatic crystals, which frequently become scarlet while cooling, but which, if they still remain yellow when cold, instantly become scarlet if rubbed or otherwise mechanically agitated. According to Warington this change is due to the transformation of the rhombic prisms into acute square-based octohedrons with truncated summits. If the yellow prismatic crystals are placed under the microscope, and are then touched, the change to the red variety may be observed to go on through the mass of contiguous crystals, accompanied by a slight movement, but the external form of the crystals remains unchanged, consequently pseudomorphous crystals are produced, and the larger rhombic prisms have been resolved into a mass of minute octohedrons. Frankenheim asserts that by the application of a very gentle heat, both the red and the yellow crystals may be sublimed together, and he believes that the vapour of the yellow crystals passes off at a lower temperature than that of the red. Warington found that the precipitate produced by iodide of potassium in chloride of mercury, appeared under the microscope to be composed of rhombic laminæ, which gradually altered their form by the truncation of the edges, until they disappeared, while square-based octohedrons were produced in their place.

The iodide is clearly capable of existing in two crystalline forms belonging to different systems, and of passing from the one form to the other, either by diminution of temperature or by simple mechanical means. Such a substance would seem to be likely to possess peculiarities in its modes of expansion under the influence of heat. In order to test this the iodide was submitted to the same experimental treatment as that employed in the case of the iodide of silver, and previously described in detail.

Homogeneous rods of the iodide of mercury were heated in paraffine in the expansion apparatus described and figured in the previous paper, and the extent of expansion due to a given range of temperature was noted. The apparatus was standardised by means of a rod of fine homogeneous silver. The same micrometer, reading to $\frac{1}{100000}$ th of an inch, was employed, and the mode of conducting the experiments was precisely the same as in the case of the iodide of silver. Two slight changes were made in the apparatus however:—the one consisted in the substitution of a massive stone base for the wooden one hitherto used; and the other the replacement of the glass rods moving in stuffing boxes, by curved equal-armed levers moving over the rim of the trough, by which means the leakage of hot paraffine at the stuffing boxes was prevented.

Bars of the iodide of mercury were cast in clean glass tubes, and here at the outset the experimental difficulties commenced. For not only was it difficult to obtain a homogeneous rod, on account of the

volatilisation of the iodide at a temperature slightly exceeding its melting point, but the rod when cold was found to be so brittle that it usually broke in the attempt to remove the glass envelope from the outside. Eventually good rods were procured by slowly melting the iodide in thin glass tubes and annealing in hot paraffine. When the whole was cold the glass was cut on the outside, and carefully broken off the ends of the rod, which were sawed plane by a fine steel saw, and then furnished with metal caps, and the rod was placed between the levers of the expansion apparatus. After heating the bar once or twice in paraffine to a temperature approaching its melting point, longitudinal rifts appeared in the glass envelope, which was then easily removed, leaving a clean homogeneous rod of the iodide.

On heating a mass of the crimson amorphous iodide, it turns yellow at 126° C., and just before the melting point is attained the yellow changes to a deep red-brown. The liquid resulting from the fusion has the appearance of liquid iodide of silver, that is to say, it has the exact colour of bromine. The liquid when cooled solidifies to a red-brown solid which speedily becomes yellow, and at 126° C. it changes to the crimson octohedral variety. Distinct cracking sounds, due to inter-molecular movements, were heard during the continuance of the change. Heat is absorbed when the red iodide changes to yellow, and is given out when the yellow iodide changes to the red.

A bar of the iodide was placed in the expansion apparatus, melted paraffine was poured upon it, and when the index had become quite steady, a gentle heat was applied to the paraffine. The index showed a regular and slow expansion until a temperature of 126° C. was reached, when the bar began to change from the octohedral to the prismatic condition, and without further rise of temperature rapid expansion took place. The temperature was kept constant until the change was complete, and was then slowly raised. A regular expansion now took place under a higher coefficient than before the molecular change, and this continued until the melting point was attained. The results were concordant.

The expansion in passing from the solid to the liquid condition was determined by weighing mercury in a tube, and afterwards filling it to the same height with fused iodide. The specific gravity of each substance being known, and the weight of equal volumes, the expansion could obviously be readily determined.

The coefficient of cubical expansion for 1° C. from 0° C. to the point of change— 126° C.—was found to be:—

$$\cdot 0000344706.$$

At 126° C., during the change from the red octohedral to the yellow prismatic condition, the body increased in bulk to the extent of:—

$$\cdot 00720407.$$

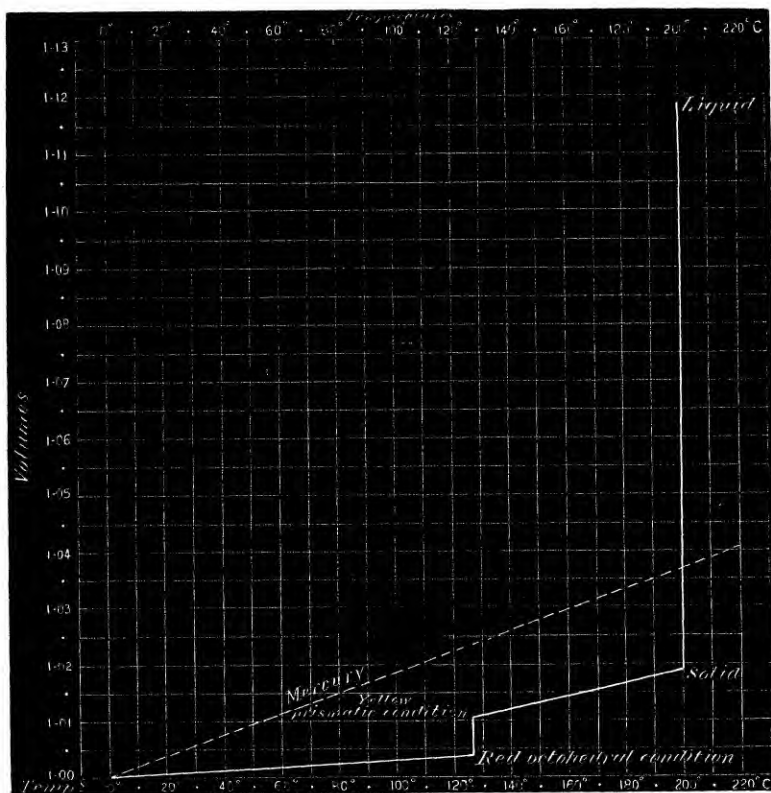
The coefficient of cubical expansion for 1° C. from 126° C., after the change to the melting point 200° C., was

$$\cdot 0001002953.$$

Thus, if we suppose a molten mass of the iodide of mercury to be cooling down from 200° C. to 0° C., the following would be the volumes under the conditions indicated:—

Volume at 200° C. of the liquid mass		=	1·1191147
" " " solid mass		=	1·0190453
" 126° C. (yellow prismatic condition)		=	1·0115378
" " (red octohedral condition)		=	1·0043337
" 0° C.		=	1·0000000

The changes are shown at one view in the accompanying curve table, in which the expansion of mercury is given for comparison.



According to Schiff the specific gravity of the octohedral iodide is 5·91; while Karsten makes it 6·2009, and Boullay 6·320.

Two distinct specimens with which we worked gave respectively—

(1). 6·3004

(2). 6·2941

The specific gravity of the fused iodide was found by the method before described to be

5·2865.

Thus the specific gravities corresponding to the five marked conditions shown in the curve table are as follows:—

Specific gravity at 0° C.		= 6·297
„ „ 126° C. (octohedral condition)		= 6·276
„ „ „ (prismatic condition)		= 6·225
„ „ 200° C. solid		= 6·179
„ „ „ liquid		= 5·286

II. “A Comparison of the Variations of the Diurnal Range of Magnetic Declination as recorded at the Observatories of Kew and Trevandrum.” By BALFOUR STEWART, F.R.S., Professor of Natural Philosophy in Owens College, Manchester, and MORISABRO HIRAOKA. Received January 10, 1879.

In a previous paper by one of the authors (“Proc. Roy. Soc.,” vol. xxvi, p. 102) a table is given (Table II) exhibiting monthly means of the Kew diurnal declination-range, corresponding to forty-eight points in each year, or four for each month, that is to say, approximately one every week; and, in another paper (“Proc. Roy. Soc.,” vol. xxvii, p. 81), another similar table exhibits monthly means of the Trevandrum diurnal declination-range for weekly points. In the present paper these two tables are compared together.

It became obvious to the writers, when engaged in making this comparison, that the turning points in the curve, which represented the variations of the Kew declination-range, were on the whole in point of time before the corresponding points in the Trevandrum curve.

While this result might have been rendered evident by making the numbers of the tables above-mentioned at once into curves, yet it was found to become more apparent to the eye and freer from inequalities by adopting a certain amount of equalization.

Accordingly, the Kew and Trevandrum tables were transformed into others, with the same time-interval between their numbers as in

